The Theory of Positrons* Revisited

By Scott Matheson Hitchcock

THE ORIGINAL PAPER* [Phys. Rev. 76, 749 – Published 15 September 1949] BY RICHARD P. FEYNMAN IS EXAMINED AND SHOWN TO BE INCORRECT WHERE TIME AND ITS DIRECTION ARE CONCERNED. IMPLICATIONS FOR TIME REVERSAL, TIME TRAVEL, ARROWS OF TIME, AND SPACE-TIME DIAGRAMS ARE DISCUSSED. THE NATURE OF THE VACUUM AS SPACE IS DISCUSSED.

The PDF full version of this paper* is at:

https://authors.library.caltech.edu/3520/1/FEYpr49b.pdf

Introduction

Space-time diagrams have been in use for over 100 years and have misled the physics world about time. These space-time diagrams apparently originating with Minkowski in 1908 have had widespread misuses and abuses by scientists leading to persistent fallacies about time. It is proved here that time reversal is a false artifact from using space-time diagrams incorrectly. Space diagrams or causal networks eliminate time paradoxes and are more appropriate for cause and effect mapping of particle interactions with the use of Feynman diagrams. Implications for time reversal, time travel, arrows of time, and space-time diagrams are discussed. The nature of the vacuum as 'space' and Feynman nodes used in causal networks are discussed. Quantum gravity as a property of the vacuum is illustrated. Missing or dark mass and energy are seen to be properties of the vacuum. Black holes and their function as vacuum phenomena are demonstrated.

THIS WORK IS BASED IN PART ON ILLUSTRATIONS FROM HANS REICHENBACH'S BOOK "THE DIRECTION OF TIME" [Ref. 1]

The Abstract that follows is from Feynman's original paper cited above:

"The problem of the behavior of positrons and electrons in given external potentials, neglecting their mutual interaction, is analyzed by replacing the theory of holes by a reinterpretation of the solutions of the Dirac equation. It is possible to write down a complete solution of the problem in terms of boundary conditions on the wave function, and this solution contains automatically all the possibilities of virtual (and real) pair formation and annihilation together with the ordinary scattering processes, including the correct relative signs of the various terms. In this solution, the "negative energy states" appear in a form which may be pictured (as by Stückelberg) in space-time as waves traveling away from the external potential backwards in time. Experimentally, such a wave corresponds to a positron approaching the potential and annihilating the electron. A particle moving forward in time (electron) in a potential may be scattered forward in time (ordinary scattering) or backward (pair annihilation). When moving backward (positron) it may be scattered backward in time (positron scattering) or forward (pair production). For such a particle the amplitude for transition from an initial to a final state is analyzed to any order in the potential by considering it to undergo a sequence of such scatterings. The amplitude for a process involving many such particles is the product of the transition amplitudes for each particle. The exclusion principle requires that antisymmetric combinations of amplitudes be chosen for those complete processes which differ only by exchange of particles. It seems that a consistent interpretation is only possible if the exclusion principle is adopted. The exclusion principle need not be taken into account in intermediate states. Vacuum problems do not arise for charges which do not interact with one another, but these are analyzed nevertheless in anticipation of application to quantum electrodynamics. The results are also expressed in momentum-energy variables. Equivalence to the second quantization theory of holes is proved in an appendix."

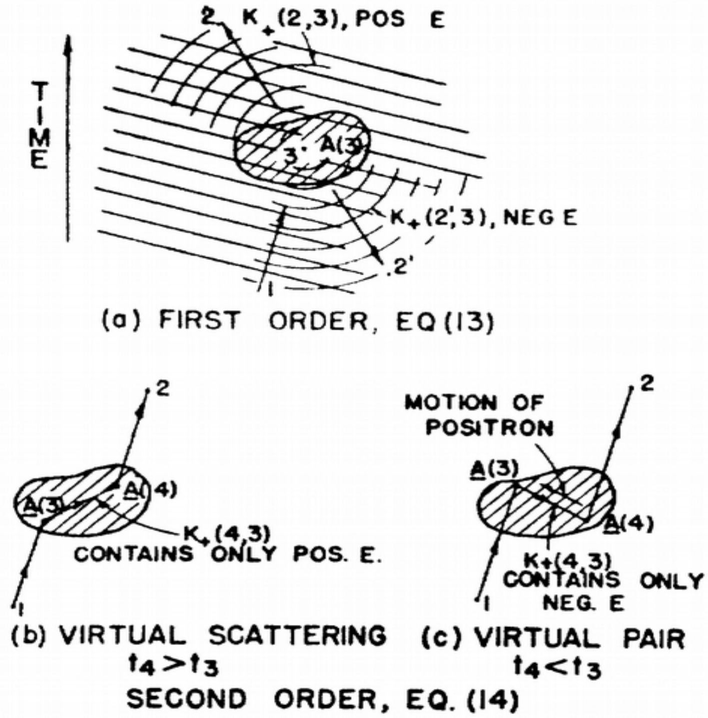


FIG. 2. The Dirac equation permits another solution $K_+(2, 1)$ if one considers that waves scattered by the potential can proceed backwards in time as in Fig. 2 (a). This is interpreted in the second order processes (b), (c), by noting that there is now the possibility (c) of virtual pair production at 4, the positron going to 3 to be annihilated. This can be pictured as similar to ordinary scattering (b) except that the electron is scattered backwards in time from 3 to 4. The waves scattered from 3 to 2′ in (a) represent the possibility of a positron arriving at 3 from 2′ and annihilating the electron from 1. This view is proved equivalent to hole theory: electrons traveling backwards in time are recognized as positrons.

NOTE: IN the FIGURE ABOVE THE LAST LINE STATES THE CONCLUSION THAT "electrons traveling backwards in time are recognized as positrons". This is an INCORRECT artifact due to the a priori ASSUMPTION that time is a dimension and a component of space-time. This is clearly not the case as one can see in the figures that follow:

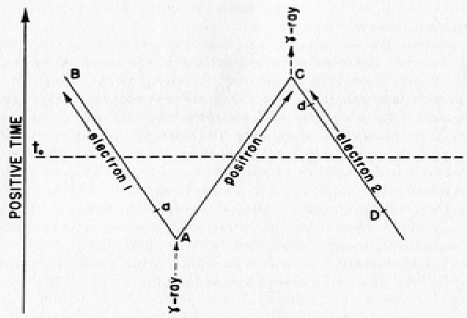


Fig. 38. Pair production and pair annihilation in a Wilson cloud chamber.

Conceptions of this kind were developed by E. C. G. Stückelberg and R. P. Feynman.[1] Their investigations showed that a positron—that is, a particle of the mass of an electron, but carrying a positive unit charge—can be regarded as an electron moving backward in time. The negative unit charge of the electron, which travels in the opposite time direction, has the same physical effects as the charge of the positron traveling forward in time; and therefore the two interpretations cannot be distinguished observationally.

Feynman showed that these conceptions can be used for an explanation of pair production and pair annihilation. It has been observed on photographs taken in a Wilson cloud chamber that, upon incidence of a γ-ray, an electron and a positron are generated from "nothing" and, starting from the same point, travel along different paths. The positron is usually not long-lived; it encounters some other electron traveling free through space and then merges with it in an act of collision. These two particles thus vanish completely, leaving as their effect

[1]See E. C. G. Stückelberg, "Remarque à propos de la création de paires de particules en théorie de relativité", *Helv. phys. Acta*, Vol. 14 (1941), pp. 588–594; and "La mécanique du point matériel en théorie de relativité et en théorie des quanta", *ibid.*, Vol. 15 (1942), pp. 23–37. Also see R. P. Feynman, "The Theory of Positrons", *Phys. Rev.*, Vol. 76 (1949), pp. 749–759.

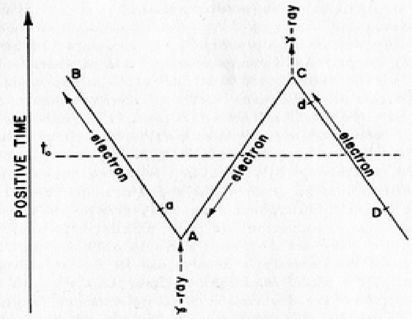


Fig. 39. The process of figure 38 regarded as the world line of a single electron, which from *C* to *A* travels backward in time.

only a new γ-ray starting from the point of collision. Figure 38 may illustrate these processes. Positive time is represented by a vertical line going upward; the other solid lines represent world lines of particles. Dotted lines indicate the world lines of the γ-rays. In the event *A*, the incident γ-ray produces a pair consisting of electron number 1 and a positron. In the event *C*, the positron collides with electron number 2; this pair is annihilated in the collision, the only trace being the γ-ray starting at *C*. In the photograph, the paths of the particles are visible and show a spatial arrangement similar to that of the solid lines in the diagram; the γ-rays are not visible in the photograph.

According to Feynman, we can as well interpret the process diagramed in figure 38 by regarding the train of lines *DCAB* as the world line of one single electron, which from *C* to *A* travels backward in time, as indicated in figure 39. Instead of three particles, we thus have only one. This interpretation has the advantage that we need not speak of pair production and pair annihilation; the one particle is there all the time. The causal anomalies of creation from nothing and vanishing into nothing are thus eliminated; however, in exchange for them another causal anomaly enters the description: the electron travels part of its path backward in time.

We meet here with a new illustration of the theory of equivalent

STEP 1 : REMOVE TIME FROM SPACE-TIME LEAVING JUST SPACE

264 *The Time of Quantum Physics*

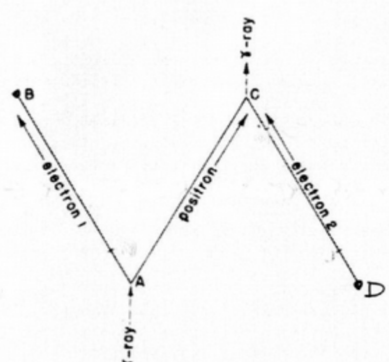


Fig. 38. Pair production and pair annihilation in a Wilson cloud chamber.

30. Particles Traveling Backward in Time 265

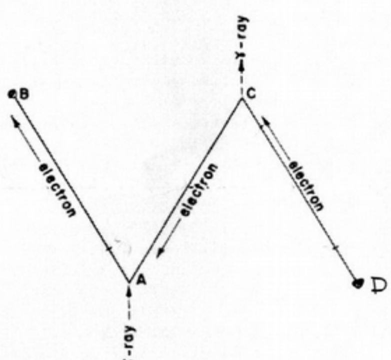


Fig. 39. The process of figure 38 regarded as the world line of a single electron, which from *C* to *A* travels backward in time.

STEP 2: CONVERT TO CAUSAL NETWORKS

A, B, C, D ARE NODES OF NETWORKS FIXED IN SPACE

LET $d \equiv d_{AB} = d_{AC} = d_{DC}$ LET $V = V_{AB} = V_{AC} = V_{DC} = V_{CA}$

∴ THEN WE DERIVE TRANSIT TIMES BETWEEN NODES:

$$t_{AB} = t_{AC} = t_{DC} = \boxed{t} = t_{AB} = t_{CA} = t_{DC} = \boxed{\frac{d}{V}}$$

264 *The Time of Quantum Physics*

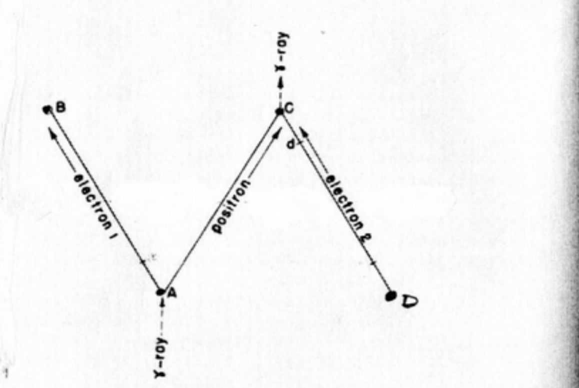


Fig. 38. Pair production and pair annihilation in a Wilson cloud chamber.

30. Particles Traveling Backward in Time 265

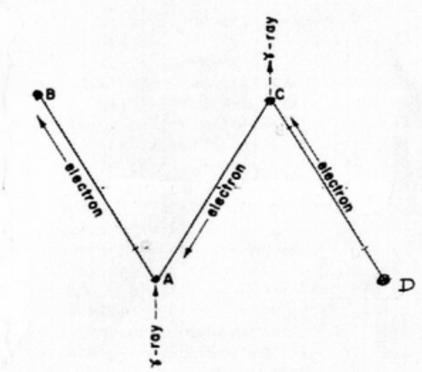


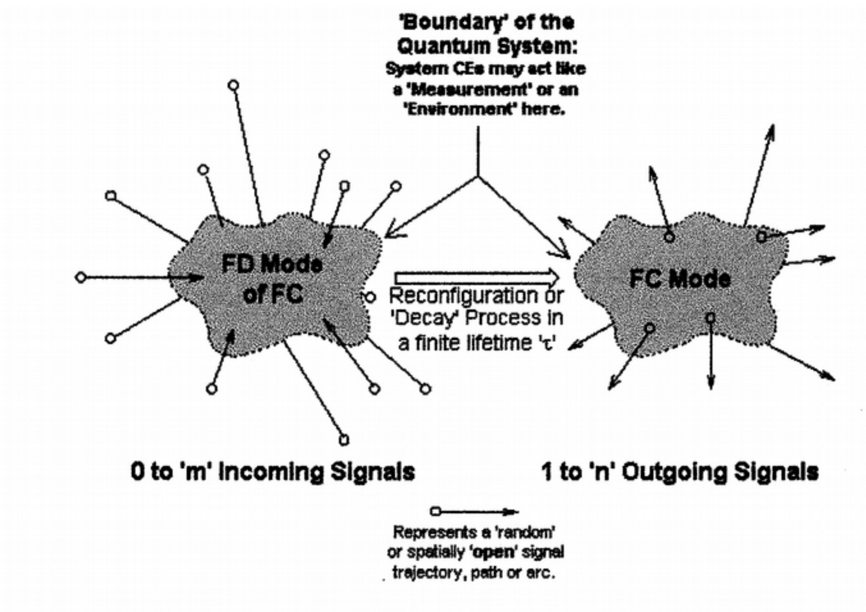
Fig. 39. The process of figure 38 regarded as the world line of a single electron, which from *C* to *A* travels backward in time.

NOTE THAT THE POSITRON (FIG.38) IS MOVING FROM A TO C IN SPACE ONLY IN A DIRECTION OPPOSITE TO THE ELECTRON (FIG 39) FROM C TO A. WITHOUT TIME CONFUSING THE DIAGRAMS, THE TIME REVERSAL INTERPRETATION IS NOT NEEDED. TIME IS A DERIVED CONCEPT, NOT FUNDAMENTAL LIKE SPACE.

Illustrated in the above three figures is that if you take the 'time' out of space-time diagrams you are left with space diagrams whose various particle interactions represent nodes in a space network of evolving objects in the vacuum. At this point the cause and effect patterns in complex networks [causal networks] representing the evolution of particle systems should be used. The nodes in these networks where interactions or spontaneous decays and emissions occur can be represented by my model of Feynman clocks or Feynman detectors as outlined in my papers. Time reversal is an irrelevant concept with this model. Time travel paradoxes also disappear. Particles such as the positron being a time reversed electron as proposed by Feynman are not possible or necessary with correct space [a.k.a. causal network] diagrams.

From the paper: “Feynman Clocks, Causal Networks, and the Origin of Hierarchical 'Arrows of Time' in Complex Systems. Part I. 'Conjectures'” February 2001

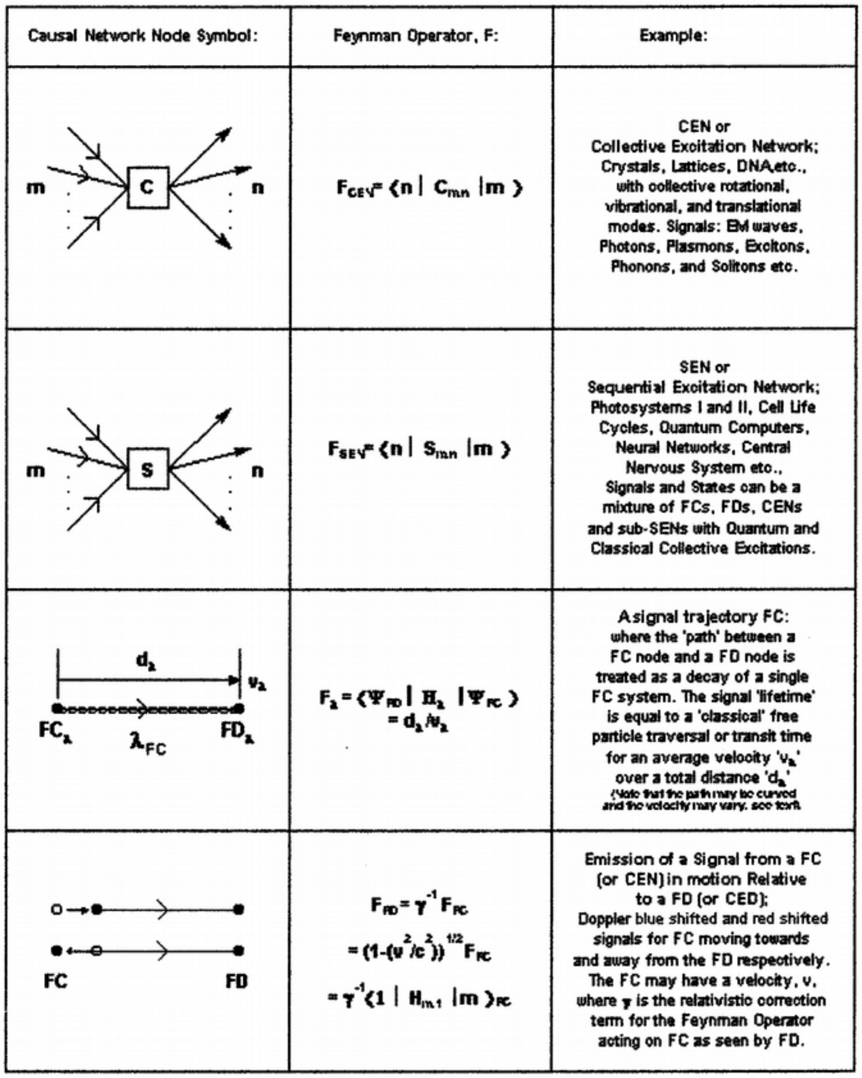
We have the following figures representing how to build causal networks to replace space-time diagrams [click on images to link to the papers]:



Illustrated above is a **Feynman Clock [FC] node** used to build a causal network. The FC absorbs incoming signals thus becoming a FD In the case of 0 signals it may be in an excited or unstable state on its own. In the case of m incoming signals, the node acts as a logic gate or computational device that decays or processes the signal resulting in outgoing signals upon whose exit the FC state is restored to a neutral configuration. Signals produced by this reconfiguration process can then move along the causal network to other FD or FC nodes. Systems of thses FC can be used to model complex cause and effect processes at all size scales.

Causal Network Node Symbol:	Feynman Operator, F:	Example:
m = 0 ○ n = 0	$F = \langle 0 \mid H_{0,0} \mid 0 \rangle$	'Vacuum', Equivalent 'mass' = 0
m = 0 ● n = 0	$F = \langle 0 \mid H_{0,0} \mid 0 \rangle$	Stable Particle or System Equivalent 'mass' ≠0
m = 0 n = 2	$F = \langle 2 \mid H_{0,2} \mid 0 \rangle$	Vacuum Fluctuations; Virtual Pair Production
m = 0 n = 1	$F = \langle 1 \mid H_{0,1} \mid 0 \rangle$	Simple Decay; Fluorescence, Relaxation of Collective Excitations
m = 1 n = 1	$F = \langle 1 \mid H_{1,1} \mid 1 \rangle$	'Linear' Transmission of Signals, Logic Gates
m = 0,1 n	$F = \langle n \mid H_{0,n} \mid 0 \rangle$	Multiparticle 'Spontaneous' Decay of a Nucleus, Big Bang
	$F = \langle n \mid H_{1,n} \mid 1 \rangle$	Scattering, Stimulated Decay or Emission through Collisions
m n = 0,1	$F = \langle 0 \mid H_{m,0} \mid m \rangle$	Fusion, Creation of System in an Excited State, With or Without a 'Target Mass'
	$F = \langle 1 \mid H_{m,1} \mid m \rangle$	Neurons, 'Irreversible' Quantum or Classical Logic Gates, Information 'Funnels'
m n	$F = \langle n \mid H_{m,n} \mid m \rangle$	The General Form of the Feynman Clock, Node, or Gate
m_B G n_R	$F_G = \langle n_R \mid H_G \mid m_B \rangle$	A Feynman Clock in a Gravitational Field with blue(m) and red(n) shifts of in/out signals respectively

Figure 8: Feynman Node Representations for building causal networks.



Causal Network Node Symbol:	Feynman Operator, F:	Example:
m C n	$F_{CEN} = \langle n \mid C_{mn} \mid m \rangle$	CEN or Collective Excitation Network; Crystals, Lattices, DNA,etc., with collective rotational, vibrational, and translational modes. Signals: EM waves, Photons, Plasmons, Excitons, Phonons, and Solitons etc.
m S n	$F_{SEN} = \langle n \mid S_{mn} \mid m \rangle$	SEN or Sequential Excitation Network; Photosystems I and II, Cell Life Cycles, Quantum Computers, Neural Networks, Central Nervous System etc., Signals and States can be a mixture of FCs, FDs, CENs and sub-SENs with Quantum and Classical Collective Excitations.
d_λ v_λ FC_λ λ_{FC} FD_λ	$F_\lambda = \langle \Psi_{FD} \mid H_\lambda \mid \Psi_{FC} \rangle = d_\lambda / v_\lambda$	A signal trajectory FC: where the 'path' between a FC node and a FD node is treated as a decay of a single FC system. The signal 'lifetime' is equal to a 'classical' free particle traversal or transit time for an average velocity 'v_λ' over a total distance 'd_λ' (Note that the path may be curved and the velocity may vary, see text)
FC FD	$F_{FD} = \gamma^{-1} F_{FC}$ $= (1-(v^2/c^2))^{1/2} F_{FC}$ $= \gamma^{-1} \langle 1 \mid H_{m1} \mid m \rangle_{FC}$	Emission of a Signal from a FC (or CEN) in motion Relative to a FD (or CED); Doppler blue shifted and red shifted signals for FC moving towards and away from the FD respectively. The FC may have a velocity, v, where γ is the relativistic correction term for the Feynman Operator acting on FC as seen by FD.

Figure 9: CEN, SEN node representations for building causal networks.

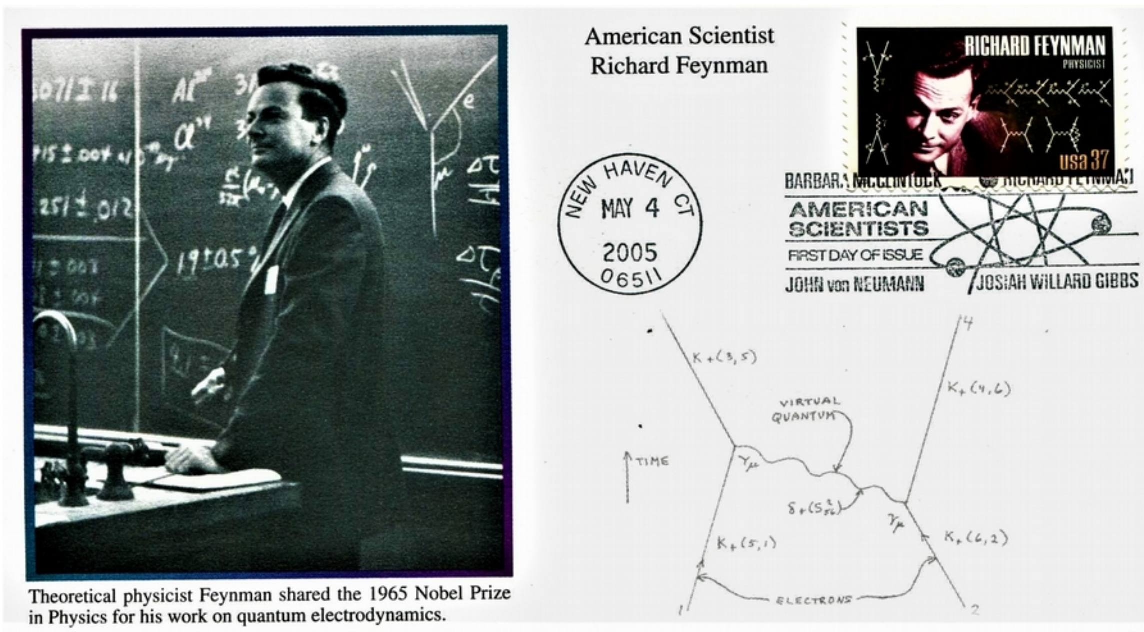
This leads to the following: [1] Feynman diagrams can be represented as Feynman Clocks nodes connected by incoming or outgoing particles leading to space maps of cause and effect patterns in space WITHOUT TIME and [2] Every point in the vacuum can be though of as a VIRTUAL Feynman Clock that become REAL Feynman Clocks when particles are present, interact or decay. Time is a computed artifact from network activities using the Brains T-computer. See my papers below to see how the nodes composed of Feynman Clocks/Detectors form causal networks where the links between nodes are space paths of particles.

Arrows of time are constructions based on the links between nodes in causal networks. These networks can be used to define arrows of time as constructions using the t-computer of our brain to make maps of the changes in real physical systems where time is derived by a process of signal mapping from changes in the states of an observed system. The key here is the observation of <u>change</u>.

In other words there is no time dimension [as in space-time] to 'reverse' in.

<u>A MAP IS NOT THE TERRITORY – Alfred Korzybski [1931]</u>

<u>NO CHANGE, THEN, NO TIME – J. B. Priestley [Ref.2, 1964]</u>



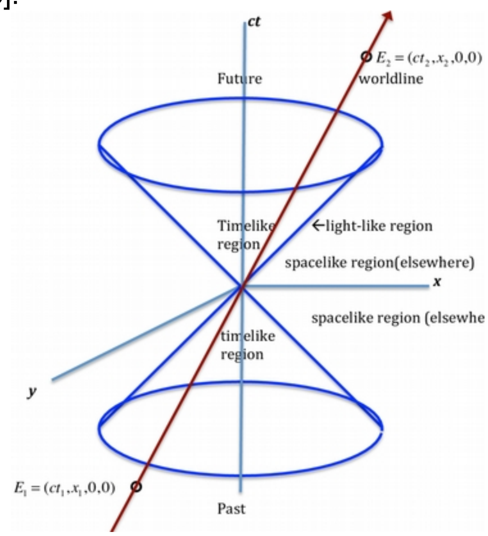
Theoretical physicist Feynman shared the 1965 Nobel Prize in Physics for his work on quantum electrodynamics.

Note: in the Feynman Diagram in the figure above, the arrow of time direction assumed for this space-time diagram implies that the virtual particle exchange between electrons could be interpreted FALSELY as going backward in time from left to right. This points out the error of assuming time as a dimension since it sets up the prejudice that time is reversible. Removing time from this picture leaves space and a causal network with NO time paradox such as reversibility. **<u>In the Feynman Diagram above you can see that the reversibility of the direction of the virtual particle actually represents a process reversal best mapped using CAUSAL NETWORKS discussed in my other papers on Research Gate.</u>**

PROCESS REVERSAL is *NOT* time reversal !

TIME REVERSAL, TIME TRAVEL, AND SPACE-TIME DIAGRAMS:

The **Minkowski diagram**, also known as a space-time diagram, was developed in 1908 by Hermann Minkowski and provides an illustration of the properties of space and time in the special theory of relativity. It allows a qualitative understanding of the corresponding phenomena like time dilation and length contraction without mathematical equations. See the figure below [click on this image to link to source article on Research Gate]:



The apparent **time symmetry** associated with reversal of processes in particle physics seems to conflict with irreversible processes in complex systems made of these particles. This transition from reversible particle interactions to irreversible ensemble behaviors is due to a misunderstanding about the relationship of ’time’ to information flow. Information originates in the re-configurations of unstable systems and ’flows’ via signals to other systems. The key point is that unstable systems represent a source for the direction of information flow and therefore a way to construct arrows of time that track information or particle flow in space without a time dimension.

This means that if one reverses a particle collision process then information still flows ’away’ from the unstable system created at the site of the interaction of the particles. Any arrow of time associated with information flow always points away from re-configurations of unstable systems. **From this point of view there is no time symmetry for particle collisions, only process symmetry.** As we have seen above, process reversal is not time reversal.

Time reversal is a statement about information flow reversal, not a change in direction of a non-existent fundamental time dimension of the universe.

In Feynman's example [from this paper] one can have a gamma ray creating a positron and electron. One can also have a positron colliding with an electron to create a gamma ray. These can be considered reverse processes of each other but not time-reversed versions of each other. The processes occur in the vacuum [i.e. space] and therefore "process reversal is not time reversal". I think that this example of process reversal represents a kind of process symmetry and perhaps process equivalence in quantum physics. In my other papers I describe how arrows of time and their 'direction' are computed artifacts mapping the spatial direction of processes that are observed. This should clarify the issue regarding **violation of T-invariance** as a false artifact resulting from assuming time exists as a 'dimension'.

As we have seen above time reversal is often confused with process reversal. This mistake has permeated physics since the introduction of Minkowski space-time diagram in 1908. The dimension and direction of time as we use it in everyday life is a construction based on the interaction of the observed world with our ’minds’ and our ’clocks’ as maps of change that we obsrve for objects in space.

Popular ideas about ’time reversal’ would require reconstruction of information states [or **infostates**] of the universe as a whole or at least a sufficiently large local infostate for ’travel’ back in time to an ’earlier’ state. Since all local systems are entangled with the infostate of the universe as a whole we see that we can only create the illusion of time reversal by construction of a ’set’ of configurations of matter that mimic an earlier configuration of the irreversibly evolving universe as a whole. At the quantum scale the flow of information is away from unstable systems. To create an unstable system incoming information from the environment is required. In this sense time reversal does not exist.

Time travel has three popular modes of expression. The first is ’backward’ ’in time’ as discussed above. The second is ’instantaneous’ or ’zero elapsed time’ travel across space. The third is travel into the ’future’ also ’in time’. All three require access to information about the ’destination’ space that is assumed to exist ’simultaneously’ with the traveler and the problem is how to transport an observer into one of these non-local infostates. This requires that past and future infostates of the universe ’exist’ concurrently. The problem here is that previous or past infostates are ’lost’ as they are ’computed’ into future ones by the dynamics of the evolving universe at all hierarchical scales of complexity. The ’lost’ (really we mean ’processed’) information specific to any ’historical’ infostate means that ’backward’ time travel is not possible and future infostates have not been computed yet.

We compute our future actions in response to past information in our memories. This allows us to compute ’time’ in order to predict ’future’ evolutionary patterns. In this sense we are examples of ’time machines’.

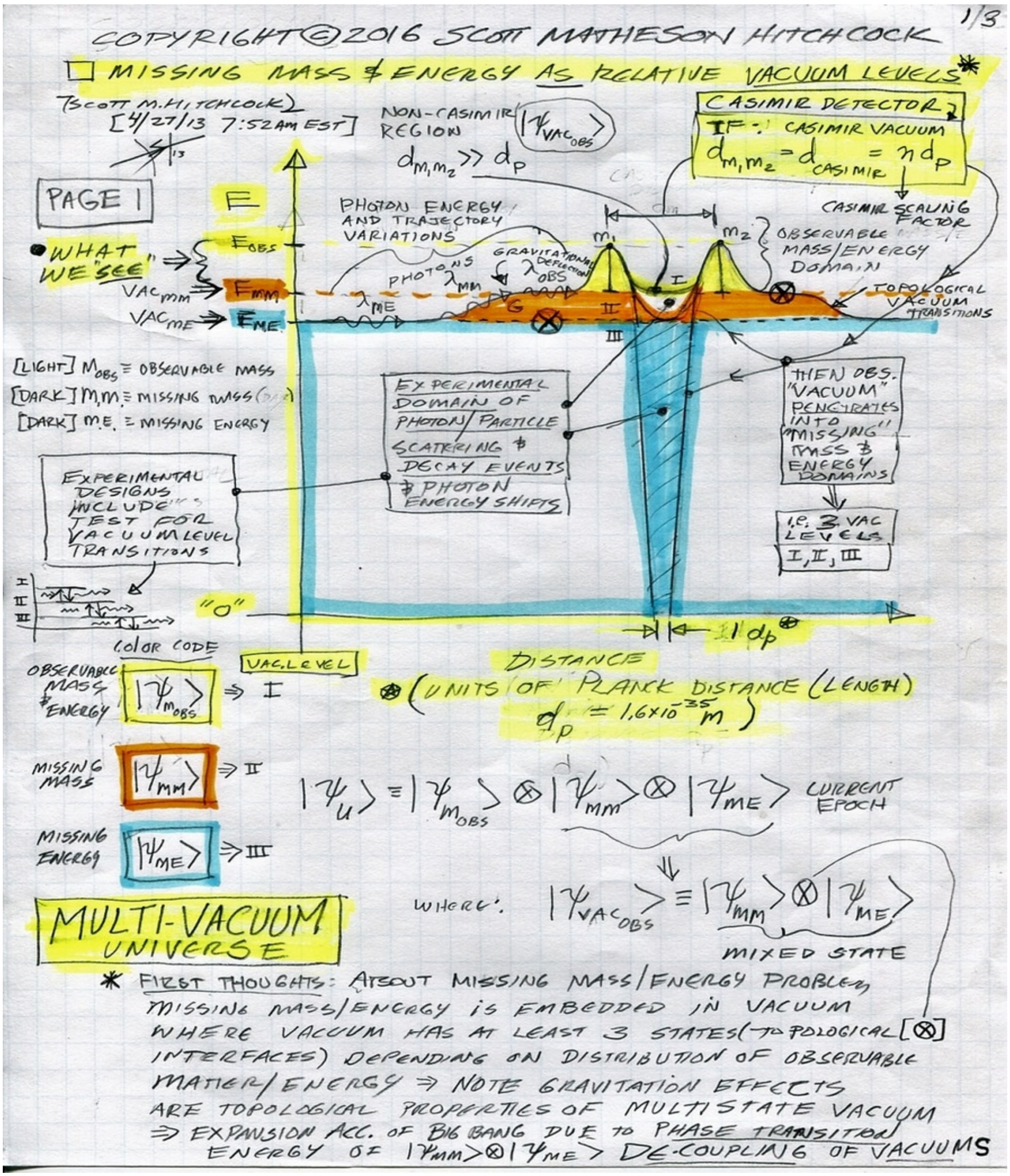
Our ability to ’travel’ into the past is just our ability to access memories. Our ability to ’travel’ into the future is our ability to ’imagine’ evolutionary scenarios based on extrapolation of patterns formed by processing information. It appears that we are stuck in the here and ’now’. What about ’instantaneous’ or ’zero elapsed time’ travel across space via wormholes or some exotic quantum entanglement effect? It appears that the ordinary real matter we are made of is highly resistant to instantaneous parallel displacement or teleportation in space.

Popular culture notions about time travel may be misguided at best since they are the result of our misinterpretations of our constructed maps of time rather than originating from a deeper understanding of how we create time from information. This is the source of many philosophical and religious paradoxes relating to the origin and evolution of the universe where our ’time’ map constructions are projected onto the universe as a space-like ’dimension’. We may see that the re-conceptualization of ’time’ as a ’construction’ or information structure will open doors to a deeper understanding of the ’changes’ in the universe that we associate with ’time’.

All the various **arrows of time** constructed to map change are relational and relative to a standard clock or our internal clocks. Feynman clocks are systems that have a finite lifetime in an excited or unstable higher energy state that decay producing signals [e.g. photons]. Thus arrows of time can be represented as vectors pointing from Feynman clock node A that produces a signal to a Feynman detector state of another Feynman clock node B in a causal network.

APPENDIX 1: The nature of space as the vacuum and time as the measure of change in the configurations of matter and energy in the vacuum.

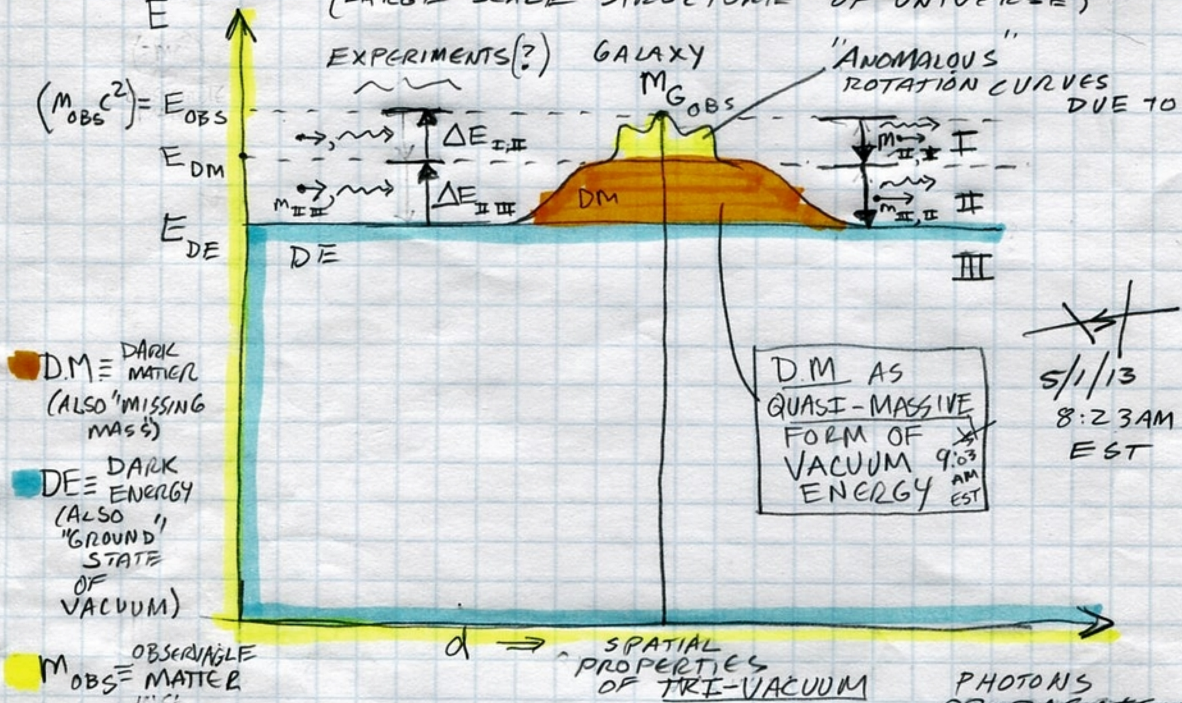
The **vacuum** is where all the visible matter and missing dark mass, matter and energy reside. The changes in the configurations of of these elements of the vacuum give rise to signals with information content that can be used to construct time and its direction along pathways in **causal networks.**

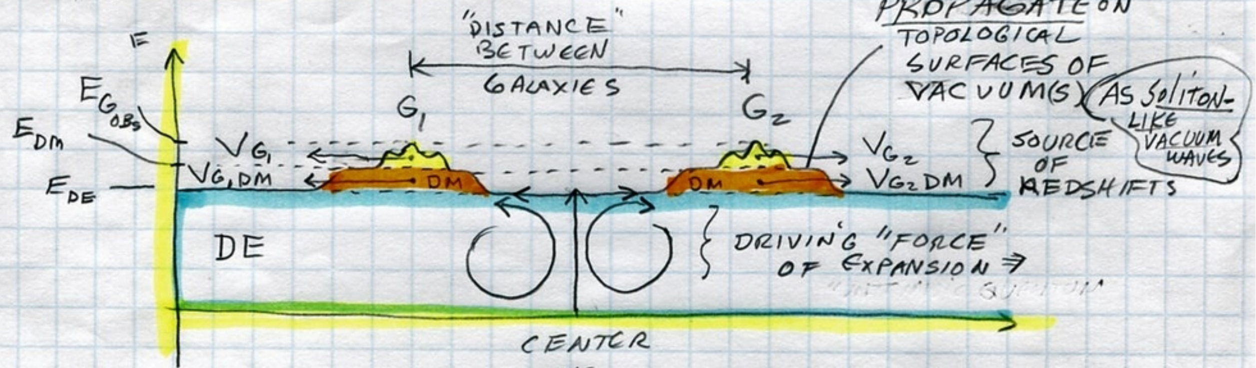


PAGE 2

EVOLUTION OF VACUUM STATES

⇒ COSMIC PHASE TRANSITIONS OF "VACUUM"
(LARGE SCALE STRUCTURE OF UNIVERSE)





⇓

DE "SOURCE" OF ACCELERATED EXPANSION

① DM "TRAVELS" WITH M_{OBS}

② BOTH DM & M_{OBS} ARE "PRECIPITATED" FORMS OF D.E. → PHASES "ANALOGOUS" WITH ICEBERGS IN OCEAN

M_{OBS} IS "SOLID STATE" OF DE – ANALOGY

DM IS PHASE TRANSITION BETWEEN DE AND M_{OBS}

ALL "MISSING" MASS AND ENERGY ARE VACUUM COMPONENTS OF THE MULTI-VACUUM UNIVERSE

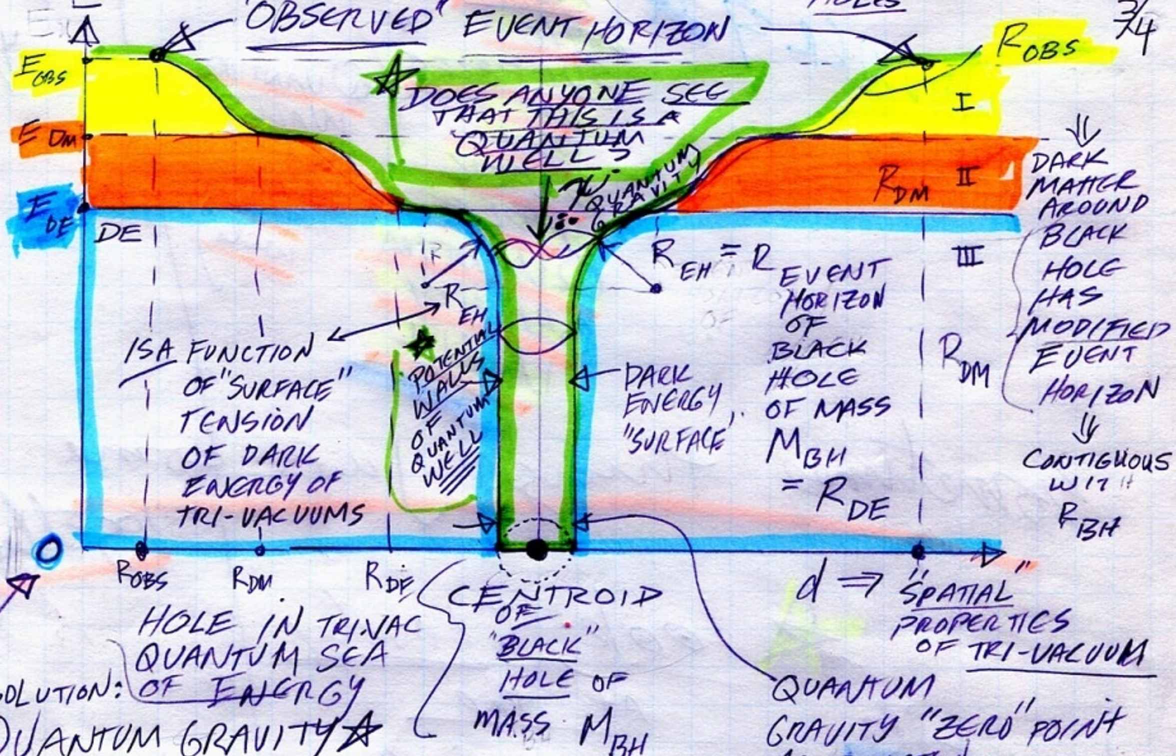
A.K.A. → TRIVACUUM → TRIVAC → TVAC → START: 3:38 PM

THE MULTI-VACUUM UNIVERSE AND "BLACK" HOLES

5/30/2016

TOPOLOGY OF "SPACE" NEAR BLACK HOLES

3/4



HOLE IN TRIVAC QUANTUM SEA OF ENERGY

CENTROID OF "BLACK" HOLE OF MASS M_{BH}

QUANTUM GRAVITY "ZERO" POINT AS FUNCTION OF PLANCK DISTANCE SCALAR: d_P AND DARK ENERGY SURFACE OF MASS, M_{BH}

SOLUTION: QUANTUM GRAVITY ☆

$$|R_{BH}\rangle_{OBS} = |R_{OBS}\rangle \otimes |R_{DM}\rangle \otimes |R_{DE}\rangle$$

⇕

KEY TO QUANTUM GRAVITY ← TRI-VACUUM TOPOLOGY OF QUANTUM ENERGY SEA THROUGHOUT THE UNIVERSE

SOLUTION ⇓ TO QUANTUM GRAVITY ☆ WHERE

$$|\phi\rangle = |V_I\rangle \otimes |V_{II}\rangle \otimes |V_{III}\rangle$$

↑

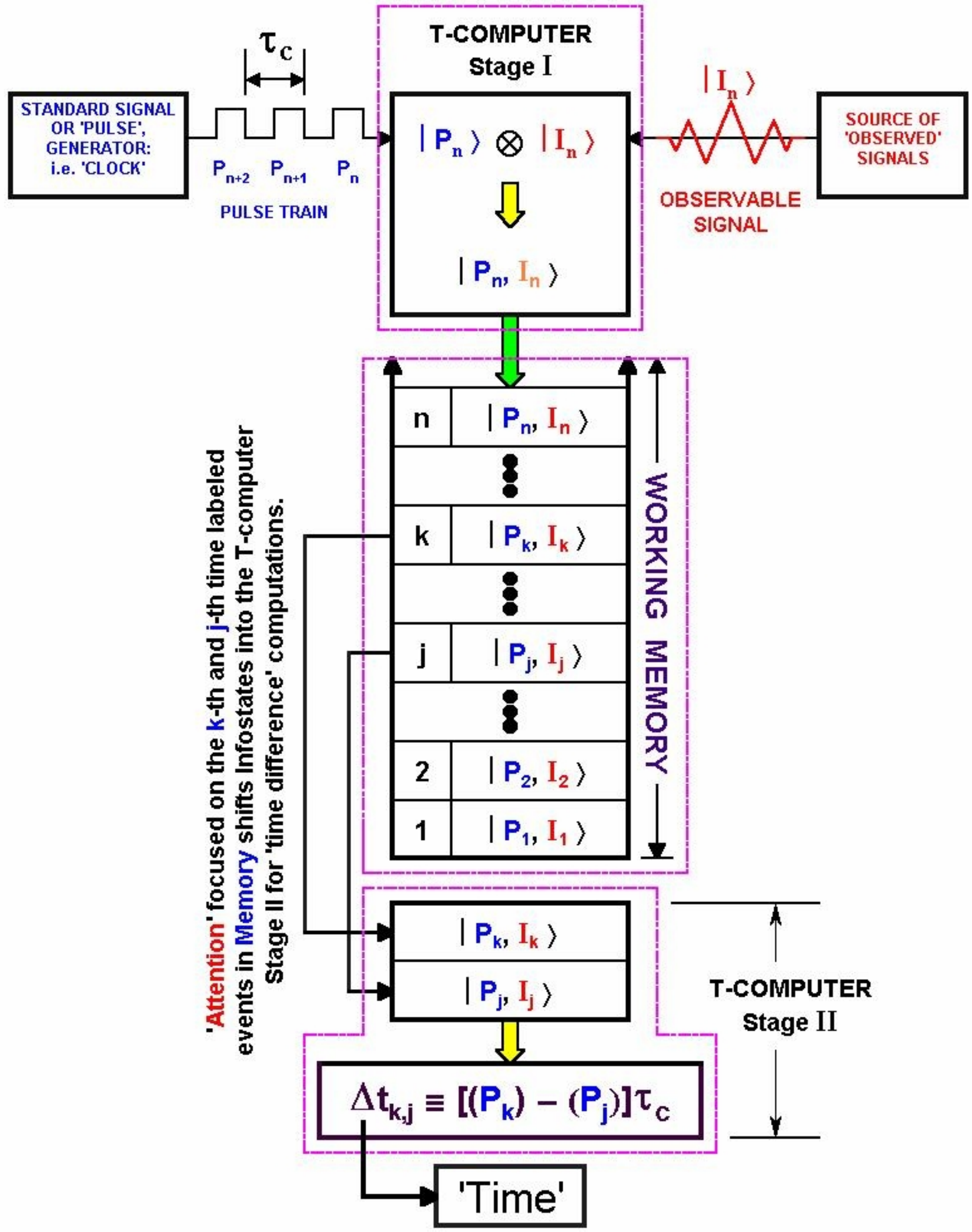
"ZERO" POINT OF TRI-VACUUM QUANTUM SEA

End: 4:15 pm 5/30/2016

∴ BLACK HOLE IS REALLY A SINGULARITY AS IT IS USED IN COMPLEX ANALYSIS



☆ TOPOLOGY OF VACUUM A.K.A. PATH INTEGRAL IN TRIVAC SPACE



APPENDIX 2: The T-computer of the brain logic diagram showing how time is created.

$$\tau_U = \alpha\tau_{strong} = \frac{\hbar}{\Gamma_{strong}} \quad (24)$$

For a FC system driven by the weak interaction (or 'electroweak') we have:

$$\tau_U = \beta\tau_{weak} = \frac{\hbar}{\Gamma_{weak}} \quad (25)$$

For a FC system driven by the electromagnetic interaction we have:

$$\tau_U = \delta\tau_{em} = \frac{\hbar}{\Gamma_{em}} \quad (26)$$

and for a gravitational FC system we have:

$$\tau_U = \epsilon\tau_{grav} = \frac{\hbar}{\Gamma_{grav}} \quad (27)$$

where the lifetimes are related by real scalar constants α, β, δ, and ϵ. The unified 'lifetime', τ_U is then:

$$\tau_U = \alpha\tau_{strong} = \beta\tau_{weak} = \delta\tau_{em} = \epsilon\tau_{grav} \quad (28)$$

APPENDIX 3: Unification of the fundamental forces of nature using time.

IN CONCLUSION:

Q: Is time travel possible?

A: Yes, you can travel to your future [a 'place' that does not 'exist' until it is 'created' by changes in the 'now' of your part of the universe]. Your consciousness travels with your body via the sequence of evolving 'nows' of your body and mind. There is no past to return to. There is no future to jump to. There is only now. Time 'travel' is a one-way trip for all of us where the future is created by the changes in our 'nows'. [For more details see my other papers at: https://www.msu.edu/~hitchco4/]

Q: Why?

A: Process reversal is not the same as time reversal. Most time travel scenarios confuse this point. We create time as a measure of change in the states of systems undergoing processes such as 'aging' of our bodies. We can reverse some processes locally with the application of 'order' in the form of energy to reconstruct a state of system that we consider to be a previous configuration of that system. Change does not occur in time. Change occurs independent of the time. Time is a construction that we have created to map irreversible and reversible processes. All this is relative to our choice of clocks, which are also subject to change. Space and time are human-made maps. The space-time of physics is a mathematical construction whose goal is to map the real world's evolutionary processes via laws that explain the past and attempt to predict the future based on observed or experienced patterns of change. 'Now' is the only reality we can experience.

Q: Why is the belief that time travel is possible so pervasive in science fiction and science?

A: Time travel is a fundamentally a fantasy that feeds ones desire to change events in a past that doesn't exist or a future that has yet to be created by the universe out of the present 'now' – neither the past or future exist as some sort of place we can travel to. Time travel as part of physical theories is mathematical only. As far as the emotional need of 'scientists' to believe in time travel, I can only say that this may originate in their narcissistic desire to control events outside of their limitations – to make the universe conform to their emotional and irrational desires. This is what usually happens in time travel fantasies in science fiction and the movies. While 'time travel' is an easy vehicle to move a story along in fiction, it also represents an easy way to assert dominance over irreversible or unpredictable change. In conclusion time travel is a belief with followers who fervor borders on the irrational thinking found in religion. 'Now' is the only reality regardless of relativistic transformations that really represent slowing down or speeding up of the metabolic processes of our bodies or energy flow processes in our instruments. Therefore "be here now" and enjoy surfing on your cosmic wave of 'now'!

REFERENCES:

1. Hans Reichenbach. The Direction of Time. Edited by Maria Reichenbach, Dover Publications, Inc., Mineola, NY, 1999.

2. J. B. Priestley. Man and Time. Crescent Books, London, UK, 1964. Page 64 "No change, then, no Time".

3. Martinus Veltman. Diagrammatica: the Path to Feynman Diagrams. Cambridge University Press, UK, 1995. See Appendix D, pages 243-244.

4. Michael A. Nielsen and Issac L. Chuang. Quantum Computation and Quantum Information. Cambridge University Press, UK, 2000.

5. T-computers and the Origins of Time in the Brain By Scott Matheson Hitchcock 2007

6. The Creation of Time from Substance and Space By Scott Matheson Hitchcock 2002

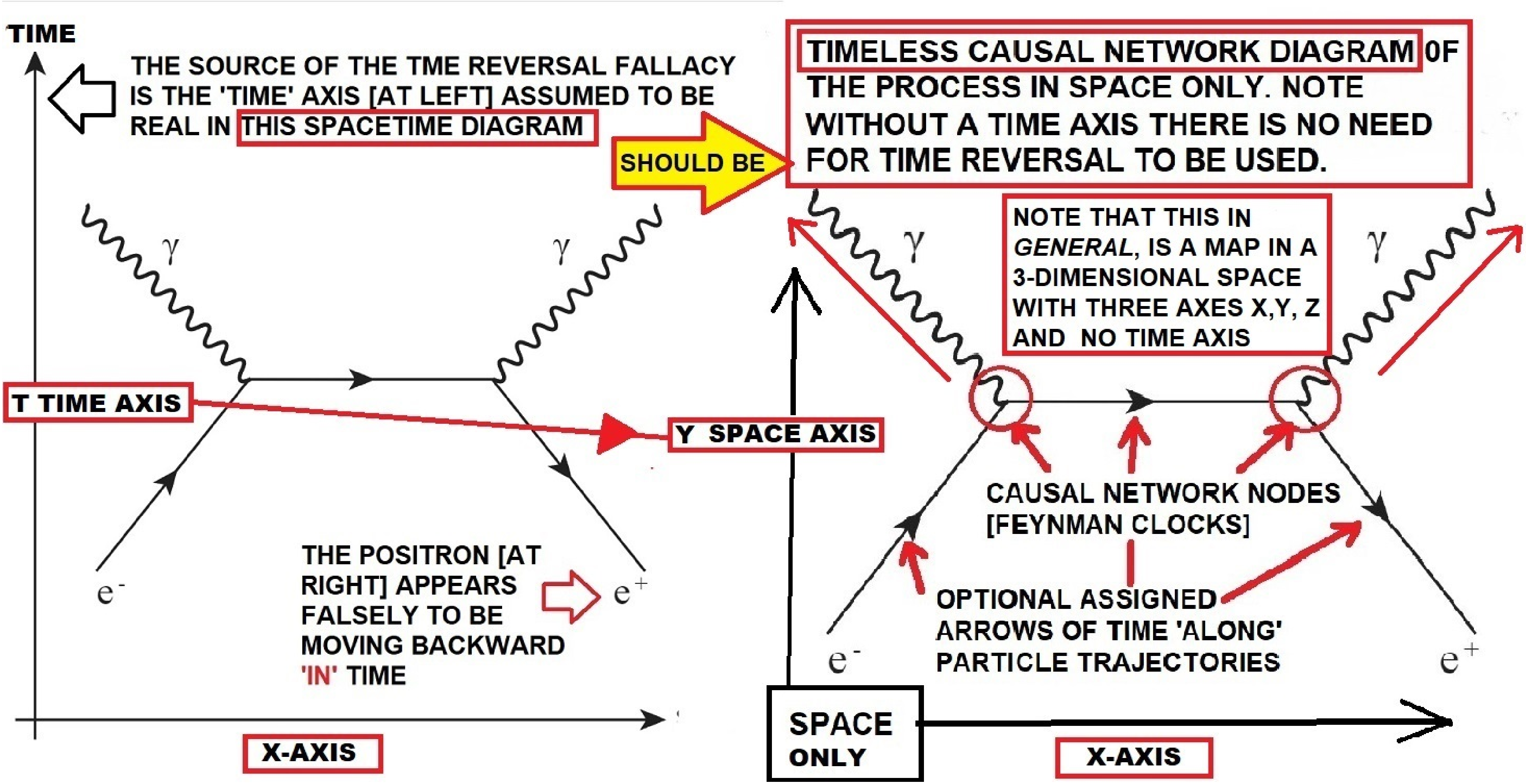
7. Time and Information, The Origins of 'Time' from Information Flow In Causal Networks and Complex Systems By Scott Matheson Hitchcock 2001, IHEP invited talk.

8. Time and Information By Scott Matheson Hitchcock 2001

9. Feynman Clocks, Casual Networks, and the Origin of Hierarchical 'Arrows of Time' in Complex Systems from the Big Bang to the Brain Presented Wednesday June 2, 2000 at IHEP Protvino, Russia By Scott Matheson Hitchcock, invited talk.

10. Feynman Clocks, Causal Networks, and The Origin of Hierarchical 'Arrows of Time' in Complex Systems. Part 1: 'Conjectures' By Scott Matheson Hitchcock 2000

11. Quantum Clocks and the Origin of Time in Complex Systems By Scott Matheson Hitchcock 1999



WHY Feynman's Positron Time Reversal Proposal in 1949 is WRONG AND THE TIME REVERSAL & TRAVEL MYTHS are *FINALLY CLEARED UP* by SCOTT MATHESON HITCHCOCKS THEORY OF TIME